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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/846,536	05/02/2001	Wen-Ting Chu	TS1999-646B	4121
28112	7590	04/20/2004	EXAMINER	
GEORGE O. SAILE & ASSOCIATES			NADAV, ORI	
28 DAVIS AVENUE			ART UNIT	
POUGHKEEPSIE, NY 12603			PAPER NUMBER	

2811

DATE MAILED: 04/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/846,536	Applicant(s) CHU ET AL.	
	Examiner ori nadav	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 20-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitations of a metal ring structure continually decreasing in thickness from each side of, to the center of top portion of said substantially straight walled via hole, as recited in claim 20, is unclear as to how the metal ring structure continually decreasing in thickness, since figure 7B depicts the metal ring structure continually increasing in thickness as its approaches the center of the via. It is also unclear from the side of which element the metal ring structure continually decreasing in thickness.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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1. Claims 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagashima (5,312,773) in view of Harada et al. (5,341,026).

Nagashima teaches in figure 7 and related text a metal structure 30 on a semiconductor substrate, a substantially straight walled via hole 40 in an insulator layer 34, 38 exposing a portion of an underlying lower level interconnect structure 32,

a recessed metal plug structure 48 located in a bottom portion of the substantially straight walled via hole, with the recessed metal plug structure 48 overlying and contacting the portion of the lower level interconnect structure 32, exposed in the substantially straight walled via hole;

the metal structure 30 comprised with a metal segment 36 located only on a first portion of a smooth top surface of the insulator layer, and

with the metal structure 50 comprised with a metal ring structure completely located in a top portion of said substantially straight walled via hole contacting top surface of said recessed metal plug structure, with said metal ring structure continually decreasing in thickness from each side of, to the center of top portion of said substantially straight walled via hole.

Nagashima does not teach an underlying lower level metal interconnect structure and the wiring connections of the second interconnection layer, such that there is an absence of the metal segment on a bare second portion of the insulator layer.

Harada et al. teach in figure 1 an underlying lower level metal interconnect structure and a metal structure 100 comprised with a metal segment 101, 102, 103 located only on a first portion of a smooth top surface of the insulator layer (the metal segment 101, 102,

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103 is the metal which is located in the area on the right side of the via hole) with an absence of the metal segment on a bare second portion of the insulator layer (the area located on the left side of the via hole).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to connect Nagashima's device to an underlying lower level metal interconnect structure and to a metal segment located only on a first portion of a smooth top surface of the insulator layer with its on a bare second portion of the insulator layer, in order to reduce the contact resistance of the device, and in order to use the device in an application which requires specific wiring connections, respectively. The combination is motivated by the teachings of Nagashima who points out that the underlying lower level polysilicon interconnect structure can comprise of other materials.

Regarding claim 21, Nagashima does not teach a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms. Harada et al. teach a lower level metal interconnect structure with an underlying and overlying titanium tungsten layer. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the

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underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms in Nagashima's device in order to protect the lower level metal interconnect structure with conventional barrier layer, of which official notice is taken, and because it is well within the skills of an artisan to use a lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, and underlying and overlying layers of a thickness between about 100 to 1500 Angstroms, respectively, in order to provide adequate conductivity to the device. Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979. Note further that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claims 22-23, Nagashima teaches a recessed metal plug structure comprised of tungsten. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms in Nagashima's device, because it is well within the

skills of an artisan to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms, in order to reduce the size of the device and in order to provide adequate conductivity to the device, respectively. Note that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claim 24, Harada et al. teach a metal ring structure 103 comprising aluminum spacers. . It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use aluminum spacers in Nagashima's device, in order to reduce the contact resistance of the device. Note that substitution of materials is not patentable even when the substitution is new and useful. Safetran Systems Corp. v. Federal Sign & Signal Corp. (DC NIII, 1981) 215 USPQ 979.

Response to Arguments

Applicant's arguments with respect to claims 20-24 have been considered but are moot in view of the new ground(s) of rejection.

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Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(571) 272-1660**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**



O.N.
April 16, 2004

ORI NADAV
PATENT EXAMINER
TECHNOLOGY CENTER 2800